

## Cubesat Fine Sun Sensor (WFSS)

Completed Technology Project (2015 - 2017)



## Project Introduction

A second generation Wallops Fine Sun Sensor (WFSS) was developed as a 2016 IRAD project. The project for 2017 will be to assess the need for radiation hardening and complete thermal-vacuum and vibration testing of the 2016 design. In order to make full use of the improvements and expand the application potential, a set of housing designs will be established and proved that provide a range of accuracy/fields of view (FOV) for application to specific mission needs.

The goals of the 2016 effort were to improve the performance of the first generation WFSS by an order of magnitude, decrease the power draw by an order of magnitude, and to improve the processor to allow all data processing to be carried out on board. To meet those goals, the circuit was redesigned and new calibration techniques and support infrastructure were developed. The end result of the 2016 project was a prototype sensor that will be ready for environmental testing.

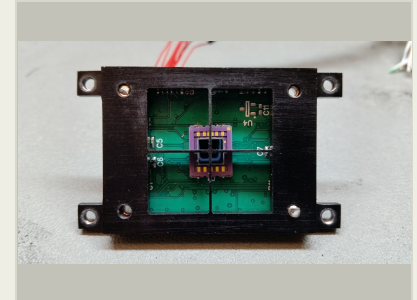
The 2017 effort will complete environmental testing on the FY16 prototype and develop a selection of housings to customize the sensor for different applications. Environmental testing will include performing thermal vacuum and vibration testing and evaluating the need for radiation testing and hardening. Thermal vacuum and vibration testing will take place using WFF assets. A radiation engineer will be brought on to evaluate the new design, and to identify ways to harden the design if necessary.

Environmental testing is expected to have a duration of 3-4 months. The design and testing of housing configurations will be performed during the remainder of the year. Increasing the height of the cruciform shade within the housing will theoretically increase the accuracy over a narrower field of view. Conversely, a wider FOV can be obtained at the cost of accuracy. Evaluating the accuracy of the WFSS as a function of FOV will enable the housings to be customized to a particular application and increase the versatility of the sensor.

Project deliverables will include a more robust design, an assessment of potential radiation issues and a plan for conducting radiation testing, and a quantified relationship between sensor FOV and accuracy that will allow for housing customization to match mission requirements.

## Anticipated Benefits

- Missions flying a first generation sensor could use information gathered from the error investigation portion of this project to improve the way data is handled
- Missions still in the design phase or requiring additional or backup attitude reference sensors will have a better option available



Second generation WFSS.

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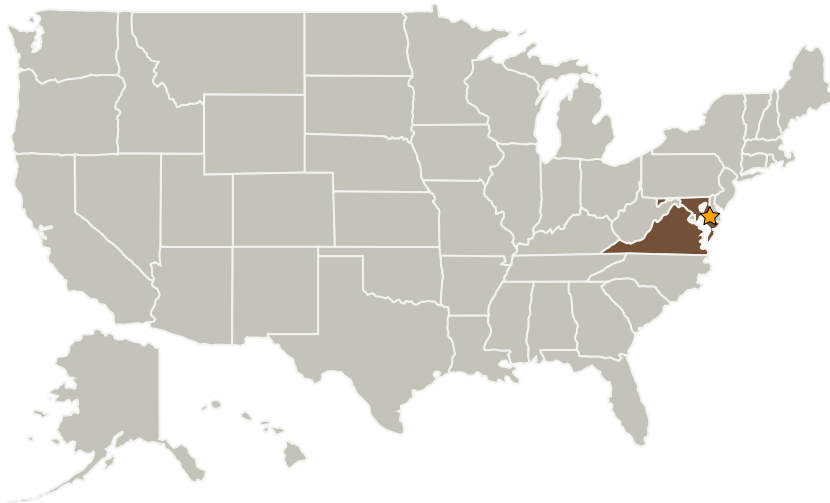
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- The WFSS fills a current need in the cubesat community for a high-accuracy and power efficient, panel-mountable Sun sensor.
- Low-cost, panel-mountable fine Sun sensors could provide an additional low-impact attitude reference in the same way that coarse Sun sensors are currently used, improving mission performance and versatility.
- Sensors could become more widely available through commercial partnerships
- Nanosatellite missions funded through other government agencies would observe the same benefits as NASA missions through interagency collaborations

## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Wallops Flight Facility (WFF)	Lead Organization	NASA Facility	Wallops Island, Virginia

## Primary U.S. Work Locations

Maryland	Virginia
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## Organizational Responsibility

**Responsible Mission Directorate:**

Mission Support Directorate (MSD)

**Lead Center / Facility:**

Wallops Flight Facility (WFF)

**Responsible Program:**

Center Independent Research &amp; Development: GSFC IRAD

## Project Management

**Program Manager:**

Peter M Hughes

**Project Managers:**Jason W Mitchell  
Daniel A Mullinix**Principal Investigator:**

Zachary W Peterson

**Co-Investigators:**Michael J Campola  
Thomas A Gadson  
Quinn A Jackson  
Carlton M Snow

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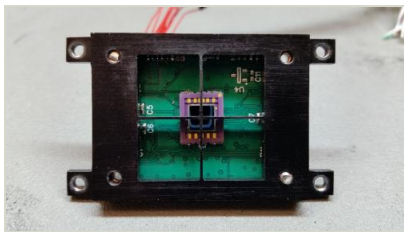


## Project Transitions

**October 2015:** Project Start**September 2017:** Closed out

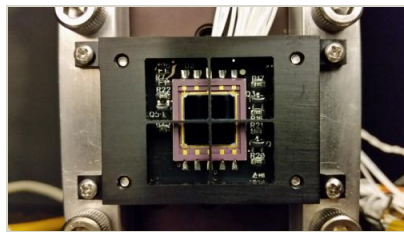
**Closeout Summary:** The purpose of the Goddard Space Flight Center's Internal Research and Development (IRAD) program is to support new technology development and to address scientific challenges. Each year, Principal Investigators (PIs) submit IRAD proposals and compete for funding for their development projects. Goddard's IRAD program supports eight Lines of Business: Astrophysics; Communications and Navigation; Cross-Cutting Technology and Capabilities; Earth Science; Heliophysics; Planetary Science; Science Small Satellites Technology; and Suborbital Platforms and Range Services. Task progress is evaluated twice a year at the Mid-term IRAD review and the end of the year. When the funding period has ended, the PIs compete again for IRAD funding or seek new sources of development and research funding or agree to external partnerships and collaborations. In some cases, when the development work has reached the appropriate Technology Readiness Level (TRL) level, the product is integrated into an actual NASA mission or used to support other government agencies. The technology may also be licensed out to the industry. The completion of a project does not necessarily indicate that the development work has stopped. The work could potentially continue in the future as a follow-on IRAD; or used in collaboration or partnership with Academia, Industry and other Government Agencies. If you are interested in partnering with NASA, see the TechPort Partnerships documentation available on the TechPort Help tab. <http://techport.nasa.gov/help>

## Images

**Second Generation WFSS**

Second generation WFSS.

(<https://techport.nasa.gov/image/24478>)

**WFSS**

First generation sensor.

(<https://techport.nasa.gov/image/18982>)

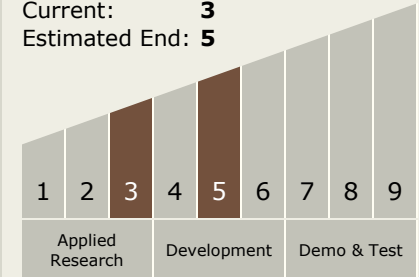
## Links

CRUQS: A Miniature Fine Sun Sensor for Nanosatellites

(<http://www.techbriefs.com/component/content/article/ntb/tech-briefs/physical-sciences/16975>)

## Technology Maturity (TRL)

Start: **3**  
Current: **3**  
Estimated End: **5**



## Technology Areas

**Primary:**

- TX06 Human Health, Life Support, and Habitation Systems
  - └ TX06.3 Human Health and Performance
    - └ TX06.3.4 Contact-less / Wearable Human Health and Performance Monitoring

## Target Destinations

Earth, Others Inside the Solar System

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GSC-16551-1  
(no url provided)

### Project Website:

<http://aetd.gsfc.nasa.gov/>